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PROGRAM RECORD

NAME		DATE				CLASS		ROOM			
		MONDAY		TUESDAY		WEDNESDAY		THURSDAY		FRIDAY	
		SUBJECT	RM	SUBJECT	RM	SUBJECT	RM	SUBJECT	RM	SUBJECT	RM
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Running Checklist

Started October 1969

to replace loose sheets
recently in use.

10/9-11/69

- Galley proofs - Biophys. J.
- Pat. ^{to discuss} Hongo on reprint making list
- Gordon Shepherd Manuscript
- Ruizal manuscript
- & followup
- reprint of Kaminsky for Pz
- visit from Miralli
- wrote about about spine stem dimensions
- visit from Gary Blackman
- wrote Fuchs
- Make 111 claim for Boulder

Running Checklist

Between Boulder & Norway

larache

Vendrik

Zucker

On return from Norway on Sept. 23, 1969
had two manuscripts & many minor items.

10/15

Manuscript for Oslo, due by end of month
Boulder manuscript, due as soon as possible
visit from Laueria

need to write Redman re Visiting Fellowship

Caianiello re his invitation

but distribute!

Bonacic - Yugoslav bioengineer

British appeal re Skyjacking

Blackman & Hubbard

Leibovic

reprints for Vernon Brooks

referee for Eccles

Galley proofs - Booplap. J.

Put Hongo ^{of di-hacca} on reprint mailing list

Gordon Shepherd Manuscript.

Ruizal manuscript

& followup

reprint & Kandinsky for Per

visit from Mirolli

write Akert about spine stem dimensions.

visit from Gary Blackman

write Zucker

Make NIH claim for Boulder

10/16

10/21

In return from Norway on Sept. 23, 1969
had two manuscripts & many minor items.

Manuscript for Goto, due by end of month
Boulder manuscript due soon opposite

wrote for Linn
need to write Pedersen re visiting Fellowship
Cincinnati re his invitation

Povacic - Yugoslav bioengineer
British appeal re shipbuilding
Bachman to Hubbard

Leitovic
reports for Vernon Brock

reports for Goto
Galler graphs - Booping P.
Put Hago on report making last

Garbar supplied Manuscript
Ruzgel manuscript

& J. J. J.
reprint of Ruzgel for P.

wrote from Michelle

wrote about about spine stem dimensions

wrote from Gary Bachman

wrote Fisher

Make 114 claim for Boulder

10/12/69
11/11/69
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Not done!

10/9-11/69

October 21, 1969

Expecting Blackman

- ✓ " Seminar Wed
- ✓ Assembly meeting Wed.
- ✓ Dinner arrangements "

Boulder manuscript - phone Betty Morris ⁶⁶²³⁸
Adelman phoned 10/20/69 & said 2 or 3 weeks

✓ Distribute Bonacic info to Harris & Fuortes

✓ Leibovic query

Reprint mailing - Hongo on list

Gordon Shepherd manuscript

Rinzell followup

Reprint of Kandrinsky for Per ^{Bill pale}

Write Albert for stem dimensions

" Zucker

Make NIH Boulder claim

* AAAS reservations thru Gerstenhaber
write Cowan

✓ NRC Brain Sciences Committee Mon Oct 27

9:30 Room 150

✓ Redman Fellowship
comes up

Write to Done Floyd re reprint list
Acknowledge these { Rosenfeld
Johannesma

writing
completed
11/9/69

figures 11/10/69

October 21, 1969

Expecting Blackburn

✓ " Seminar Wed

✓ Assembly meeting Wed.

✓ " Dinner arrangements "

10528

Boulder manuscript - Name Betty Hanz
Abelmann travel 10/20/69 to end 20/3 weeks

✓ Districtal Review info to Harriet Foster

✓ Lorraine's query

Report meeting - Hodge on list

Program prepared manuscript

Pringle's fall program

Report & handout for Per

Write report for other dimensions

" Fisher

Make MH Boulder clinic

* AAAS reservations thru Foster

Write Canon

MRC Brain Science Committee Mar Oct 57

P:30 Room 120

Redman Fellowship

Write to Dave Boyd re reprint list
acknowledge those 3 researchers

November 10, 1969

Finished writing the figures today for Boulder

Need to proof read when typed 11/13/69
clear & send off ✓

rolling * Rinzell Project

11/14 ✓ Write Dieter Lux

11/12 ✓ Write Cowan

✓ Write Balsler

○ Write Zucker

○ Study Akert reprints & write him

○ Submit NIH Boulder claim

✓ Follow up on Redman Fellowship

? Shepherd manuscript with Tom Reese

○ ✓ Reprints for Per, Bliss — also Landristy

○ Reprint Marting — Hongo etc

✓ AAAS & Gerstenhaber

○ Acknowledge Dave Boyd

○ Rosenfeld

○ Johansson.

✓ ? Referee for J. Gen. Physiol

✓ Referee for Hagins.

✓ Write U. Penn seminar declined

○ Reply Gordon Conference invitation

✓ Reprints to Jauria's student

Cable Properties MS

Oslo manuscript
8 xerox copies

8 sent to Oslo with original

1 Master - Miralli made copies from this

2 used for clearance

3 for ~~Bob Burke~~ kept for copying

6 gave to Gary Blackman

7 home

~~leave # 5 ~~with~~ in cupboard~~

4 send to Dieter Lux

5 to Jack Diamond

Could use one for Ritzel

Jack

Redman

Goldstein

Four more made

11/24/69

A for Bob Burke

B

C

D

Dendritic Neuron Theory MS

Nov. 13, finally got 8 complete xerox copies
plus original & carbon
of Boulder paper.

Sent original & carbon to Helene Jordan

8 one xerox to George Adelman

7 one xerox to Tom Reese & on to Gordon Shepherd

1 Master with notes on cover

2 will need for clearance

11/14/69 { There should 4 more in cupboard, but one is
missing. Call it # 6 & see if it turns up.

Take # 5 home

leave # 3 & # 4 in cupboard

Today sent off AAMS Square Statement to Jordan

Still need to write Par re bus comments
& other notes

Invitations from N. Carolina
Cornell

3 manuscript for AAMS; How brief?
Figures?

Rubber's permission for figures?

Benjamin Franklin

Nov. 13, finally got 8 complete copies
plus original & carbon
of Boulders paper.

Sent original & carbon to Helen Jordan
one copy to George Odell
one copy to Tom Ross & one to John G. ...

Jan 7, 1970 Tabstock

Have just cleared tables & desk
Threw out lots of material
Shelved Journals

- ① Still need to sort reprints received
- ② " " " send some reprints
- ③ " " " make new master list.
- ④ " " " check over stuff in box

⑤ NRC-BRC meeting coming up Friday

- ✓ Saw Connie Bishop today re Redman visa
- ✓ Note - Redman Fellowship already thru.

^{No Response}
⑥ Today sent off AAAS Expense Statement to Gerstenberg

✓ Still need to write Per re Lux comments
& other notes

^{saw them here 2/19/70}
declined

? invitations from N. Carolina
Cornell

? manuscript for AAAS; How brief?
Figures?

Publisher's permission for figures?

Jan 7, 1970 Top stocks

Have just cleaned tables & desks
Threw out lots of material
Standard journals

- ① Still need to sort reports received
- ② " " " " " " " "
- ③ " " " " " " " "
- ④ " " " " " " " "

WRC-BRC meeting coming up Friday

✓ See James B. King today re Redman V. 20
✓ Note - Redman Fellowship already there.

Today went off AAS papers (start to finish)

✓ Still need to write Par re bus comments
& other notes

? interview from M. G. ...
Growth

? manuscript for AAS; how big?
figures?

Redman's figures for figures.

Jan 7-15, 1970

Took care of:

- ✓ letters to Radman re housing & visa
- ✓ referee for Eccles (Rosenthal)
- ✓ note re referee for Stark
- ✓ Neuroscience local meeting & Ballot
- ✓ Brain Sciences Committee Meeting
- ✓ Gordon Shepherd's manuscript
- ✓ Referee for Burke's paper
- ✓ Letters to NC
- } Cornell & Gordon Conf.

Received reprints for 1969b

Disputed with Jose & Ruizell
I.C. vs B.C. for Just. pt. Source
& J with respect to x or t.

Wrote Steven Goldstein + reprints

Torrell Hill + "

Jon Jensen & Wallace + "

Carimela + "

Prepared outlines for two papers with
Ruizell

Jan 5-12, 1950

Took out of:

- ✓ Letter to Robinson re housing & 1950
 - ✓ Refers for books (Rosenberg)
 - ✓ Note re refers for Stark
 - ✓ Newsreels broadcast by CBS
 - ✓ Press Bureau Committee Meeting
 - ✓ Gordon Stenberg's memorandum
 - ✓ Refers for Burke's paper
 - ✓ Letter to McCarroll
- ✓ Correll & Johnson

Received reports for 1949

Discussed with Jones & Kingell
I.C. vs B.C. for det. pt. 2000
& 3 with report to x 2000

First week of Feb 1970

Took care of Page Proofs from OSLO

Referee for - Hogben (Iowa)

~~J. Gen. Phys.~~

J. Theoret. Biol.

* J. Biophys. J. (MacGregor)

{ phoned John Moore

Received 1969 a & b reprints

1967 (5) - 500 more

Now must really catch up on mailing

Letter from { Stephen Redman

} talked with Bob Burke

draft reply

Wrote Steven Goldstein + reprints

Terrill Hill + "

Jan Jansen & Wallace + "

Cerimele + "

Prepared outlines for two papers with Ringel ^{to get out}

First week of Feb 1970

Took out of paper books from Q2L0

References for - Hooper (Journ)

~~Hooper (Journ)~~

Hooper (Journ)

K. Hooper (Journ)
Hooper (Journ)

Received 1969 a & b - reprints

1967 (2) - 200 more

Now must really catch up on reading

Letter from Stephen Barber
talked with Bob Burke
draft copy

Wrote Steve Goldstein + reprints

" + Tall Hill

" + Johnson + Wallace +

" + animals

Prepared outlines for two papers with
Krieger

During 1st two weeks of Feb., managed to write
a first draft of Steady State Solutions & Input
Resistances. i.e. Pop. A, Part II, Sections A-E
& began F.

Then got interrupted by various things.

Head Cold

Biophys. Soc. Meeting

March - tried to setup Balslev seminar
Wrote Julian Jock & Stephen March 16
Notes to Manner & Arbib
Making reprints

Boulder Galley Proofs, March 10

Looking over Study Section Material
for Special Study Section
Biomechanics / Biostatistics

During 1st two weeks of Feb. managed to write
a first draft of Study Site Selections & Study
Locations in Park, with sections A-E
& pages F.

Then got interrupted by various things.

Head Cold
Pickup. See. Meeting

March - tried to set up Boulder seminar
with John Lee & Stephen March 10
Wrote to Newman & others

Making reports
Boulder Valley Project. March 10

Looking over Study Section Materials
for Special Study Section
Boulder Valley Project

April 21, 1970

✓ Last week saw Gordon Shepherd & went to Atlantic City, Soc. for Neuroscience Council Meeting

✓ This morning, finished letter of recommendation for John Evans & then that off. dictated to VCSJ by telephone

○ Also write John Evans directly

✓ * Write Mountcastle re Soc. Neuroscience meeting plans

4/23/70

○ Write Julian Jack

○ Referee for Bob Burke

✓ * Referee for Windle

✓ Claim for meeting

done

Prepare for Study Section Friday

Already sent in preliminary evaluations over a week ago

✓ Annual Report

○ Clear desks for Ringell next week

April 21, 1970

✓ Last week saw Gordon Shepherd & went to
Ottawa City, Sec. for Neuroscience Council Meeting

✓ This morning finished letter of recommendation for John
& then went off. dict to USD by telephone

✓ Also wrote letter to Sec. for Neuroscience Council Meeting
✓ K. White Mountcastle re. Sec. Neuroscience Meeting
plans

✓ Write Julian jobs
✓ Prepare for Bob Burke
✓ Prepare for Winkler

✓ Clean up meeting

Prepare for Study Section Friday
~~Write in preliminary conditions on...~~

✓ Annual Report

✓ Clear desks for Friday next week

During June, worked on papers with John Knizell with some interruptions

Took care of most figures

Draft of 1st half of 1st paper

John has drafted much of 2nd paper

July 7 - 14 Bahamas

July 16 & 18 Sara's camp Poconos

Last week of June & 1st week of July partly broken up by problems with Sara & end of school.

July 20 & ready to concentrate on completing papers.

During June, worked on papers with
John Haggell with some instructions

Took care of most figures
Draft of 1st half of 1st paper
John has drafted much of 2nd
paper

July 7-14 Bohannon
July 16-18 2nd camp Bohannon

Let write of June & 1st week
of July part of Bohannon up top
problems with 2nd & end
of Bohannon

July 20 & ready to concentrate on
1st camp Bohannon

1970

August: Got some more writing done & then got bogged down with many interruptions & finally a bad cold. Fitted in some library work & background work, but could not get the writing going again.

Sept. 1 Went over manuscript of Jerry Fishbock — (of Phil Nelson)

Visited their lab & saw their preparations.

(A) Possibility of testing more theoret. predictions with finite cylinders.

(B) Possibilities of growing synapses

Merit further discussion and exploration.

1950

August:

got some more writing done &
then got bogged down with
many interruptions & finally
a bad cold. Filled in some
library work & background
work, but could not get the
writing going again.

Sept. 1

Went over manuscript of my
book (to Mr. Black)
Visited Fairbank & saw this
preparation.

(A) Possibility of taking more
short. publications with
finite objectives.

(B) Possibility of growing papers

Want further discussion and
application.

Sept. 2 before resuming writing
have some refereeing from Windle

Phone J. Best to explore progress of his interest
in Seminar for Potomac Chapter, Soc. Neurosc.

Phoned Zucker re being reference for him.

also phoned Kalney Johnson & Dr. Sklarew.

Looking at typewcripts from Balslev

Sept. 16 - Latency period, bridge etc.

completed referee jobs

filled some special reprint requests

wrote letters in resp to spec. inquiries.

received reprints & traffic from

Collonier & Peters

received OSKO books & reprints

need to be
informed in
order to
recommend

Looked over Arbib & Grey Walter's books.
Also CUM Smith & Asimov
books on brain: re inquiries.

Sept. 2 before resuming writing
have some references from Winkler

Phase 2. Part to explore program of his interest
in seminar for Potomac Chapter, Soc. Neurosc.

Phase 3. Further re find references for him.

Also found Kellogg Johnson & Dr. Sklarson.

Looking at typewritten form Bolander

Sept. 16 - Letter, period, bridge etc.
completed reference job
filled some special reprint requests
write letter in reply to open inquiries.

received reprint requests from
Callaway & Paterson
received 8210 books & reprints

need to be
{
also consulted
books on brain; re inquiries.

10/14/70 Have done more reading on spines
i.e. Chang & Berkeley references

in Sept. Potomac Chapter & Natl. Meeting Soc for Neurosci
Met Cannon & Hunt & may wish to follow up
Lunch with K. Frank
Saw Pottala's hardware, chain of cpts.
Farewell to John Krizell
Followup on J. Best seminar arrangements
with Wade Marshall & Wagner
Reference for Zucker
Referee referrals for Science & Biophys J.
Letter to Per Andersson
Whingo visit
Lectures by Sidman & Jacobson
 ↑ good.

Natl Book in NIH library: Contemporary Research

Methods in Neuroanatomy: Ed by Nauta &

Made reservations for my seminar Ettner

Need to follow up for Potomac Chapter ~~Feb~~

meeting ~~for~~ on dendro-dendritic
with our Reese & Gordon Shepherd Feb 1971

Klee & other
Letters to job applicants, Kozhevnikov reports to Doty

10/14/50 Home base was reading on spine
i.e. Change & Barbara's references
in left. Potatoes Chapter of Vol. History book for home
Wet corner of front + map out to follow
Lunch with K. Frank
Saw Potatoes's business, clean dept.
forward to John Knight
followers of J. But some arrangements
with White Mountain & W. Jones

Already turned down
invitation from V. Penna (Summer)

& also Review for Manual of Hagens

Have to work out Summer meeting
& vacation plans.

Decided to skip Biophysics Soc meeting
in New Orleans
in February

Deferred Montreal (February)

12/10/70

Just finished J. Best seminars
(used up most of last 3 days, plus
quite a few hours earlier.)

Last week had virus.
Previous weeks (i.e. November)
held NIH Tutorial Seminars

Now time to take stock for priorities
before Xmas & then for New Year
Wm Markes & K. Frank

Need to write Montreal

Gordon Conf.

See Ed re Klee & check book with Klee
Rasmussen

Biophys J. Referee

Rudomin manuscript

Gordon Shepherd & Bishop serapes

TPS Powell

Spine Review

? Cowan on spines

Reese & Shepherd on Feb 70 Mar

Ringell letter & manuscript.

Notes to
Gelfan
MacKay

12/10/70

All thru January, struggling to
clear decks for a
concentrated effort on
spine papers.

12/30/70 & early January 1971

Phoned Giebisch re Gordon Shepherd reference
wrote Mrs Noble & later wrote son (David)

" Maurice Klee

" Boglyp J. referee

" NSF reference for John Ringell

Phoned Eugene Harris re Klee & Noble

Saw Tom Reese & Milton re seminar with Skipton & Wente

12/29

Spent day with Jews Hoberly
& wrote followup memos

12/31/70
1/4/71
1/7/71

Wrote David Noble 1/7/71

" von Hippel 1/7/71

" Giebisch 1/11/71

Munich Abstract 1/11/71

Montreal-Cordeaux 1/13/71 (May 7)

Rudomin letters & memos

1/14/71
1/15/71
1/18/71

Note to T.P.S. Powell 1/20/71

Response to Boglyp J. 1/21/71

Reference to Eliot Seltzer 2/1/71

Responses to h. Starke & T.E. Bailey 2/3/71

Confirmed announcements for Soc. Neurosci Chapter

Saw John Ringell 1/29/71

12/30/50 & early January 1951

Planned for cards re Gordon & ... reference
Write Mrs Noble of later visits ...

11 November 1950

" Biography, reference

" NLF reference for John ...

Planned ... hours re ... & Noble

Gene Tom ... & ... as ... with ...

12/21

Spent ... with ... for ...

12/31/50

1/4/51

1/7/51

Write Don Noble 1/7/51

" " 1/7/51

" " 1/11/51

Mumukh's contact 1/11/51

to ... 1/13/51 (May 1)

Barber's ... 2/11/51

1/15/51

Write to ... 1/18/51

reference to ... 1/19/51

reference to ... 2/1/51

reference to ... 2/3/51

Conference arrangements for ...

Gene Tom ... 1/29/51

Feb. 8, 1971

Last week struggling to clear decks

Exploring with Rudomin (visit to Mexico City)
Got vaccination & shot 2/5/71 (Feb 17-28)

Confirmed reservations for family to go to
Florida Keys April 8-18

Potomac Chapter Summer Tomorrow

Priorities: ① Spine papers

② Be prepared for Montreal May 7

③ Rudomin collaboration

④ Effect of field (Marks & Frank ? memo)

⑤ Spherical cell field paper

⑥ Bishop xeroxes

Contact Rossmore, Gelfan, Mackay

? Oxford in July (16-17)?

⑦ Questions of separate paper discussing
spines. maybe to follow up
on Montreal & Munich
for Science

2/6/71 proof reading for Louise Marshall
Neurosoc. Newsletter

First 3 weeks of March get paper Brodwin 15 pages of Introduction
& Method

Oct. 8, 1971

Last week struggling to clean desks

Travels with A.M. & Sara

Expanding with Ruben (visit to Mexico City)
Oct 15 - 28

Informed reservations for family to go to

Florida Keys April 8-18

Postman Chapter Summary tomorrow

Activities: (1) Spine papers

(2) Be prepared for literature May 7

(3) Ruben's collaboration

(4) Field field (Marta & Frank Evans)

(5) Special cell field paper

(6) Brochures

Contact Ruben, paper, Mark

? Oxford in July (10-15)?

(7) Ruben's separate paper discussion

Spain, maps to follow
on literature & numbers

for October

8/10/71 proof reading for Anne Marshall
Nancy, Newsletter

Get books of Mark get paper for discussion
of field work

April 2, 1971

Fortunate that completed 15 page introduction of paper B before upset over Ava Lou's impending surgery.

Also fortunate that it got advanced ^{surgery} one week from April 1 to March 25.

Things went as well as could be expected but main writing was impossible.

Did manage to take care of some paper work

Supporting Klee's fellowship applica.

Saw Ted & Henry in this comedie

Drafted annual report (July 1970-1971)

Made Montreal reservations

Wrote Roberge
rearrangements.

Also phoned camp for Sora

Contributed \$200 to Tilden Br. court bond.

Ava Lou's recovery during first week has gone remarkably well. Came home last night. Girls behaved well. Doris helped.

April 2, 1971

Late April & early May also involved

(1) referee for Biophys J.

(1) NSF

Here 2 NSF

8 referee

Mexican Student (Pumada) ✓ 6/17/71

✓ (6/17)

⑧ Eisenberg MSS from J. Gen. Physiol.

⑨ Cowan MSS from Biophys J.

✓ (6/22)

June 3, 1971

May 7
Successful trip to Montreal

Completed Munich regist., reservations, plans etc.
also Sara & Wandy's summer plans
Abstract for Neuroscience Meeting
Memo & letter to Mountcastle
Calcs re internode resistances for Tom Reese
referee Reese & Shepherd manuscript

Priorities

- 0 ① Slides for Munich
- 0 ② Short paper for Brain Research
- ③ letters { Xenia Machure (review)
Hill (re postdocs)
Schw^{Prof}ardt fager
Don Kennedy re neural coding
- ✓ ④ NSF { Bulloch ✓ (6/17)
Eisenberg (6/18)
- ✓ ⑤ Referee : for Albert (Rosenthal (2))
(6/18) for Eccles (Nicolle)
(6/22) for B.J. (Cowan & ...)
- ⑥ Reply to Ilina
- ✓ ⑦ J. Best manuscript & photos ✓ (6/17)
received 6/7/71

June 3, 1951

Successful trip to Montreal
May 7

Completed Munich report, summaries, plans etc.
also Gene & Wendy's summer plans
Contract for Transoceanic Meeting
Plans & letter to Mountcastle
Various intermediate reports for Tom Rose
reference Gene & Wendy's manuscript

Printed

- ① 2 slides for Munich
- ② Short paper for Brain Research
- ③ Letter (Gene & Wendy)

④ Still (reposters)
⑤ Summary paper

⑥ Other family re annual coding

⑦ NSF Budget (6/17)
⑧ Budget (6/17)

⑨ Reference: for Grant (Parental (2))
for Gene (Nicol)
for B.J. (Cannon &)

⑩ Reply to Gene

⑪ P. Cantimur & others (6/17)

8/19/71

Aug. 4
 August 19, 1971 returned from successful trip
 to Munich

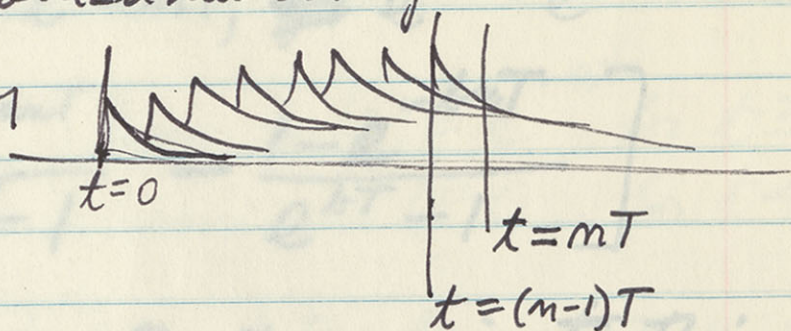
Spent time settling down, talking to Steve & others

Spent 2 or 3 days related to referee Rubio MS for Zinn
 & Rastvorby

raised interesting problems discussed with Steve
 (MS contained errors)

his 1967 paper contained interesting sum

current paper deals with



let $T = \frac{1}{f}$

If each increment in EPSP is Ke^{-at}

Then sum of these increments (for regular frequency)
 (starting from zero EPSP) at $t=0$

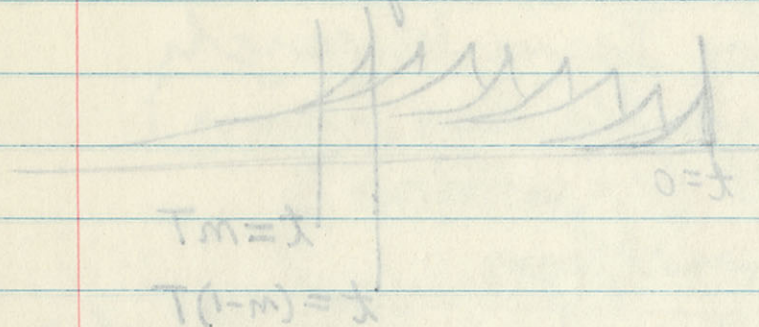
$$\begin{aligned} \text{Sum} &= K \left\{ e^{-at} + e^{-a(t-T)} + e^{-a(t-2T)} + \dots + e^{-a(t-(n-1)T)} \right\} \\ &= Ke^{-at} \left\{ 1 + e^{aT} + e^{2aT} + \dots + e^{a(n-1)T} \right\} \\ &= Ke^{-at} \left\{ \frac{1 - e^{anT}}{1 - e^{aT}} \right\} \end{aligned}$$

because $(1 - e^{aT})(1 + e^{aT} + \dots + e^{a(n-1)T}) = 1 - e^{aT} + e^{aT} - e^{2aT} + \dots + e^{a(n-1)T} - e^{a(n-1)T} = 1 - e^{anT}$

8/19/71

August 19, 1971
 returned from successful trip
 to Munich
 Aug. 4

Spent time setting down, talking to Steve & others
 Spent 203 days related to referee Rubio MS for Jim
 & Robert
 raised interesting problems discussed with Steve
 (MS contained errors)
 MS 1967 paper contained interesting sum



current paper below
 let $T = \frac{1}{2}$

look increment in EBP in K.E.
 then sum of these increments (for regular frequency)
 (starting from zero EBP) at $t = 0$
 sum of $(m-1)T \leq t \leq mT$

$$\begin{aligned} \text{Sum} &= K \left[e^{-\alpha t} + e^{-\alpha(t-T)} + \dots + e^{-\alpha(t-(m-1)T)} \right] \\ &= K e^{-\alpha t} \left[1 + e^{-\alpha T} + \dots + e^{-\alpha(m-1)T} \right] \\ &= K e^{-\alpha t} \frac{1 - e^{-\alpha m T}}{1 - e^{-\alpha T}} \end{aligned}$$

$$\text{because } (1 - e^{-\alpha T}) \left(1 + e^{-\alpha T} + \dots + e^{-\alpha(m-1)T} \right) = 1 - e^{-\alpha m T}$$

8/19/71

Similarly, for $T = 1/f$ and rounded epsp
 $K(e^{-at} - e^{-bt})$ for $a < b$



Sum for last interval
 $(n-1)T \leq t \leq nT$

$$\text{is } K \left\{ e^{-at} \left(\frac{1 - e^{anT}}{1 - e^{aT}} \right) - e^{-bt} \left(\frac{1 - e^{bnT}}{1 - e^{bT}} \right) \right\}$$

also, note that when $t = nT$, ~~e^{-at}~~ $e^{-at} = e^{-anT}$

$$\text{and get } K \left[\frac{1 - e^{-anT}}{e^{aT} - 1} - \frac{1 - e^{-bnT}}{e^{bT} - 1} \right]$$

Rubio then ~~approx~~ smooths & approximates this
 with

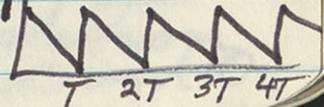
$$x(t) = K \left[F\left(\frac{f}{a}\right) (1 - e^{-at}) - F\left(\frac{f}{b}\right) (1 - e^{-bt}) \right]$$

$$\text{where } F(\alpha) \equiv \frac{1}{e^{1/\alpha} - 1} \quad \alpha = \frac{f}{a} = \frac{1}{aT}$$

See Rubio 1967, Bull Math. Bio 29: 719-736 (1967)

Whereas current paper indicates that the approx.
 mean neglect of ~~of~~ terms like for $a \neq b$.

$$K F\left(\frac{f}{a}\right) \left[e^{\frac{a}{f} \phi(t/f)} - 1 \right] \text{ where } \phi(t/f) \text{ is sawtooth!}$$



8/19/71

Similarly for $T = 1/2$ and rounded up

$K(e^{-at} - e^{-bt})$ for $a < b$

Sum for $(n-1)T \leq t < nT$ last interval

is $K \left[e^{-at} \left(\frac{1-e^{-bt}}{1-e^{-bT}} \right) - e^{-bt} \left(\frac{1-e^{-aT}}{1-e^{-aT}} \right) \right]$

also, note that when $t = nT$, $e^{-at} = e^{-aT}$

and get $K \left[\frac{1-e^{-aT}}{e^{aT}-1} - \frac{1-e^{-bT}}{e^{bT}-1} \right]$

Ratio then approximates $\frac{1}{e^{aT}-1}$

$x(t) = K \left[F\left(\frac{t}{a}\right) - F\left(\frac{t}{b}\right) \right] (1-e^{-at})$

where $F(x) \equiv \frac{1}{e^{ax}-1}$ and $a = \frac{1}{T}$

In Radio 1967, Bull Math. Soc 29: 219-236 (1967)

whereas current paper indicates that the approx. is more exact for $a < b$.

$K F\left(\frac{t}{a}\right) \left[e^{\frac{a}{b} \phi(t)} - 1 \right]$ where $\phi(t)$ is something

8/19/71

He claims approx term can be shown small

~~for~~ and, for $\frac{f}{a} = \frac{1}{aT}$ large, $F(\frac{f}{a}) \approx \frac{f}{a}$

$$\text{and } x(t) \approx K \left[\frac{f}{a}(1 - e^{-at}) - \frac{f}{b}(1 - e^{-bt}) \right]$$

↑ not as good because $b > a$

∴ generalize for variable f
use convolution

$$x(t) = k \int_{-\infty}^t f(\lambda) h_a(t-\lambda) d\lambda$$

$$\text{where } h_a(t) \begin{cases} = e^{-at} & \text{for } t \geq 0 \\ = 0 & \text{for } t < 0 \end{cases}$$

Note, when f const. & convolution from $-\infty$ to 0 is zero

$$\text{Then } x(t) = kf e^{-at} \left(\frac{e^{at} - 1}{a} \right)$$

$$= \frac{kf}{a} (1 - e^{-at}) \text{ as above.}$$

Thus, he motivates (relates) convolution expression to the earlier summation. But is this necessary?

The convolution is more general and powerful; but this does show how $f \equiv$ frequency, comes in.

also, it is interesting to examine convolution between $-\infty$ and 0

8/19/71

The limit approx term can be shown small

and, for $\frac{t}{a} = \frac{1}{aT}$ large, $F(\frac{t}{a}) \approx \frac{t}{a}$

$$\text{and } x(t) \approx K \left[\frac{t}{a}(1-e^{-at}) - \frac{t}{a}(1-e^{-at}) \right]$$

↖
not a good name
 $t > a$

is generalize for variable f
use convolution

$$x(t) = \int_{-\infty}^t f(\tau) h(t-\tau) d\tau$$

where $h(t) = \begin{cases} e^{-at} & \text{for } t \geq 0 \\ 0 & \text{for } t < 0 \end{cases}$

Note, when f const. & convolution from $-\infty$ to 0 is zero

$$\text{Then } x(t) = K \int_{-\infty}^t \left(\frac{t-\tau}{a} \right) e^{-a(t-\tau)} d\tau$$

Thus, the most correct (related) convolution expression to
the earlier summation. But is this necessary?
The convolution is more general and powerful; but
this does show how the frequency, comes in.

also, it is interesting to examine convolution
between $-\infty$ and $-\infty$

8/19/71

When $x(t) = k \int_{-\infty}^t f(\lambda) e^{-a(t-\lambda)} d\lambda$

for f variable, can write

$$x(t) = k e^{-at} \int_{-\infty}^t e^{a\lambda} f(\lambda) d\lambda$$

which is a
simpler integral

for $t=0$, set $x(0) = \gamma_0 e^{-at}$

where $\gamma_0 = k \int_{-\infty}^0 e^{a\lambda} f(\lambda) d\lambda$ is a constant

\therefore can write $x(t) = \gamma_0 e^{-at} + k f * e^{-at}$

↑
where this is convolution
from $\lambda=0$ to $\lambda=t$

Now, ~~should be~~ Laplace transform

$$L\{x\} = \frac{\gamma_0}{s+a} + \frac{L\{kf\}}{s+a}$$

$$(s+a)L\{x\} = \gamma_0 + L\{kf\}$$

Invert

$$\dot{x} + ax = \gamma_0 + kf$$

$$\dot{x} + ax = kf$$

diff. eqn.

8/19/71

$$\int_{-\infty}^t f(\tau) e^{-a(\tau-t)} d\tau = (t) \times \text{mem}(f)$$

for f variable, can write

$$\int_{-\infty}^t f(\tau) e^{-a\tau} d\tau = X(s)$$

which is a Laplace transform

$$\text{for } t=0, \text{ get } X(0) = \delta_0 e^{-at}$$

$$\text{Where } \delta_0 \text{ is a constant}$$

$$\int_{-\infty}^t f(\tau) e^{-a\tau} d\tau = X(s)$$

When this is constant

from $t=0$ to $t=A$

Now, ~~the~~ Laplace transform

$$\{X\} = \frac{\delta_0}{s+a} + \frac{1}{s+a}$$

$$(s+a)\{X\} = \delta_0 + 1$$

$$sX + aX = \delta_0 + 1$$

$$sX + aX = K$$

diff. eq.

trans

8/19/71

Completed Rubio referee for Zinn & N.R.

Priorities: { Steve's draft
Appendix for Tom Reese
Short Paper on Spines
Long Paper on Branch Supert
Long Paper on Spine Supert

? letter to Don Kennedy & Perkel
letter to Maurice Klee re Wayne London
letter to Eccles re Nicoll MS revised
? Thomas & Nicholson

? Griffith's "Mathematical Neurobiology" for Science.

? Editor Supreme of Chapman & Hall

(notice of Rosen for Wiley-Interscience
Plousey for McGraw-Hill
Griffith for Academic Press)

Both ~~Big~~ Engineering Series

8/19/51

Completed Rubin papers for Jim & M.R.

Also, take care of ~~Hoberly~~
Thesis referee

Of unsolicited theory paper
from Genell.

Accept very few future
referee jobs for a while

Send back Griffith books to
Science.

also 9/15/71 Taking stock
This has been a difficult year for several reasons:

all necessitated putting scientific output at lower priority. Also, recent trip to Europe & to & from Camp and 25th Anniversary etc have all prevented business as usual.

Now, maybe can settle down and try to complete several incomplete writing projects.

- * 1. Short paper on Spines? for MacKay ^{with Rinzel, Spines with emphasis as in talks}
2. Appendix for Tom Reese
3. Paper with Steegou $K \neq 0$
4. With Rinzel on Steady State
5. ? whether separate " " from transient if too long.
6. With Rinzel on spine calcs.
7. Spherical Neuron Field
8. Analytical Slope Indices
9. Equiv. cylinders in field & B.C.
10. Plan for book

Write Sugrham.

? write Perkel & Kennedy.

Page

9/15/71

Today's work

This has been a difficult year for several reasons: Air. Laboratory, Gene's temporary, related efforts at counseling etc. all reoriented putting scientific output at lower priority. Also recent trip to Europe & to a few camps and 25th Anniversary etc. have all prevented business as usual. Next weeks are with the same and try to complete several manuscripts writing projects.

- with right spin with members
as in table
1. 200 papers on spine? for Mackay
 2. Appendix for Tom Boer
 3. Paper with Steveson K# 0
 4. With Nigel on Stead State
 5. ? whether separate " from transient if too long.
 6. With Nigel on spine also.
 7. Spinous Newcom Field
 8. Cerebral Trace Studies
 9. Spinous. chapters in field of P.C.
 10. Plans for books
 - Write paper
 - Write book

11/5/71

previous week had meetings of
Society for Neuroscience
also NAS-NRC Committee on Brain Science
& Natl. Council of Soc.
also dinner at Aust. Embassy
saw Gordon Shepherd next night.
busy week.

This week took care of Rubio's
revised MS for Parkesbury

also fellowship reference for Rinzel
& letters to Rinzel

I phone call from Kelston

re seminar at Wisconsin

letter to Ainsby & related phone

also phoned Science editor re book review

Discussions with Tim about future
plans & personnel for Branch

Talks with Steve re his modeling

NIAID assembly of Scientists

11/2/71

presented with had meeting of
Society for Neuroscience
Gordon H.A.S. - MRC Committee on Brain Sciences
& MRC Committee of 2000
also dinner at Hotel Ambrosia
see further papers & reports
Lester & co.

Thanks to care of Rubio's
received MS for handwriting

also following up reports for Ring
& Hill to Ring

I have call from Robert
the summer of 1970
letter to MRC & related papers
also found some other books
Discussions with the other future
plans & personnel for future
talks with Steve re the meeting
MRC committee of 2000

11/24/71 Tomorrow Thanksgiving.

Observed in Court on 11/11/71

Had cold 11/13 — 11/18 bad week

Got final letter to Judge & xeroxed off
This morning.

This week F. O. Schmitt workshop phone call for May 14-16

Cancelled →

Naples-Ravello invitation

Wisconsin followup inquiry

Univ. of Chicago (Cowan) inquiry.

* Need to sort these out & make plans.

Also, see Bob Burke with Stephen, next week

See Tom Reese

get back to writing. (see two pages back)

* Did get Klee position & salary sorted out with Zim
& Zim followed up with pink sheet & letter.

(Saw Klee & wife Dec. 29)

Phil & Bob both want basic results carefully derived.

(for people who know some calculus but not sophisticated in its use)

1/5/72 Tightening discipline now
Started strict diet to get down from peak wt of 190
Must make commitments now for invited talks

Relston - Wisconsin (? May 1)

Cowan - Chicago week end of April May

Rüzel - NYU - end of Feb. 11

NRP - May 15 & 16

Gordon Conf. June ~~12~~ = 16

1/6/72

Referee Norman papers for study section

Reject book review for Science, of Russian Book

1/13/72 Got off letters to Relston, Cowan, Rüzel

Kandel phoned 1/10/72 to ask me to write
a chapter on Core Conductors & Lable Properties of
Neurons for new edition of Handbook
Deadline ^{12 to 18} months

Discussed with Phil & Bob & Ava Jan

Decided that I should do this.

Must do other papers first.

Starting notes re scope etc.

← Partly use Tutorial Seminar Notes

Foreign

British

Hodgkin & Huxley
Katz & Fatt
Adrian & Keynes
Beurle
Utley
MacKay & Evans
Longuet-Higgins
Ginsburg
Jack & Miller
Redman
Noble & Stein

German

Reichardt
Genik?
Lux

Italian

Caiamello
Onesto
Maffei

Holland

van Hooper
Johannesma
Miller

Scandinavia

Jansen & Walloe
Frankenhauer & Kernell
Rosenfalck

Russia

Berhablit group in Moscow

Develop a Reference list of Neural Modelers,
Biophysicists & Theoretical Biologists.

Here is a preliminary start, which will need to be
amplified & amended.

Foreign Separate

USA & over

Classical

Rashevsky

Sandahl

Offner

Householder

Bartholomay

Rosen

Danielli

Mathematical

Householder

Hearon

Fitz Hugh

John Ewens

Jack Cowan

Michael Arbib

Rubio

Norman

Hellerman

Griffith

Rinzler

Arxonal
Biophysical

Cole

Fitz Hugh

Adelman

Taylor

Jecor & Nossal

Ehrenstein & Gilbert

Chandler

Computer Oriented

Belmont Farley

Perkel

Magregor

Rügel

Neurophysiol. Bio Phys.

Hartline & Ratliff

Dodge & Knight

Garstein & Moore

Lange & Hartline

Kennedy & Zucker (Wilson)

& other Hartline

Walter Freeman

Burke & Nelson

Frank, Foskock

Mike Bennett

Stromwasser, Kandel, Spencer

Hagius et al

Bioengineering

Harmon

Lewis

Plonsey & Clark

Klee

Pickard

Fender

Poppo (Terzullo)

Calvin

Gerstein & Moore

Auditory (MIT)
Acoustical

Kiang &

Weiss & Peak

Rosenblith

Moise Goldstein

Gerstein

2/28/72: Things have been bad

Trouble at home, but good

Weight down to 150 (down from 170)

Invited to USA and Canada

Klee getting some things

Steve & Andy going to Europe

Went to Courant

Now, Klee will be going to Europe

beginning March 3, and going to Europe

Dedicated morning to work

afternoon, but

Quiktop (MIT)
Accountant

King &

Wright & Parks

Research Institute

Wright & Parks

Quiktop

University of California (Berkeley)

Wright & Parks

Wright & Parks

Wright & Parks

Wright & Parks

Wright & Parks

1/25/72 travel request for Gordon Res. Conf.
roughed out outside work requests for Chicago
Courant
Handbooks

still need to do Wisconsin
& ^{or outside} payment in kind to NRP

letter from Quarton: Gordon Shepherd
Tom Reese
Phil Nelson

write Kandel
Powell

2/28/72 Things have been hectic.

Trouble at home, but could improve now.

Weight down to 172 (down 19 from 1st of year)

Invited to USA Nat. Committee for IBRO

Klee giving seminar tomorrow

Steve & I made progress on EoS V & EVJ stability
props.

Went to Courant earlier. (2/11)

Now, Klee will be visiting @ house starting Mar. 1, but
beginning Week 2, writing must proceed in earnest.
Dedicate mornings to writing & defer all other chores to
afternoon. Now finish commenting on Gordon Shepherd's
reviews

1/25/72
travel reports for
received and continue work reports for Chicago
Current
Handbooks

still need to do Wisconsin
of program in kind to MRP

letter from Director: Foster
Tom Brown
Phil Johnson

write handbook
Book

2/28/72 things have been done.

trouble at home, but could improve more.

Worked down to 1/2 (about 1/2 from 1st of year)

switched to USA with committee for BRD

Klee giving summer for research

Store of 4 books prepared on 300V + 3 of state
Word to Government (2/11)

Now, Klee will be visiting & doing work at that, but
Report should be writing and process in research.
Technical writing to writing & paper allocation class to
afternoon. Technical committee on Foster's
Review

3/2/72 Begin in earnest on Pügel Papers

Old Paper A draft was June 1970

Input Resistance and Transient Solutions
in a Dendritic Neuron, for Current
Injected at One Branch. (97)
allowed (100)

Split into two

(A1)

e.g. ~~Dendritic~~
(Branch) Input Resistance, and Steady ~~State~~
~~Attenuation of Membrane Potential~~
~~Electrotonic Attenuation for input to one~~
~~Branch of~~ ~~within tree~~
for input to one branch
along branches of a Dendritic Neuron
Model

(A2)

Transient Response Functions and Attenuation
for Current injected to ^{one} Single Branch of a Dendritic Neuron
Model

Shot heads: A1 Dendritic input resistance & attenuation

A2 Transient response in a dendritic neuron

3/4/52 Paper in Bureau on Project Paper

Old Paper A draft was June 1950

Input Resistance and Transient Solutions
in a Dendritic Neuron, for Current
Project of our Bureau. (91)

Split into two

AI

~~Branch Input Resistance and Steady State~~
~~Attenuation of the Input~~
~~Electrotonic Attenuation for Input to~~
~~Branch~~
Input to our Bureau
of a Dendritic Neuron
Model

A2

Transient Response functions and Attenuation
for Current reported to our Bureau of Dendritic Neuron
Model

That Model: AI Dendritic Input Resistance & Attenuation
A2 Transient Response in a Dendritic Neuron

3/9/72 made some progress on A-1

Also, talked with Steve today & yesterday about his V, ϵ, j singularities.

We developed three good ideas for further work. See below.

He pointed out that ^{isocline} surfaces, intersections & roots are not changed when the expressions for $\dot{V}, \dot{\epsilon}$ & \dot{j} are unchanged except by a factor, ~~there~~ because when $\dot{V}=0, \dot{\epsilon}=0, \dot{j}=0$, get same surfaces.

However, factor can represent a change in sets of k values (k_5, k_6, k_7) or (k_1, k_2, k_3, k_4) and it means that the λ_s for the linearization about singularity can yield a different character for ~~the~~ singularity. He has now gotten stable & unstable spirals for third singularity, depending upon which branch \supset it lies. Also, at apex, get circular stable, he thinks.

One idea I got today from his V, ϵ, j results is that we can gain more

3/9/72 made some progress on A-1

Also, talked with Steve today & yesterday

about his V, ϵ of singularities.

His singularities are from the factorization of the characteristic polynomial

He pointed out that surfaces, intersections of

surfaces are not changed when the

expressions for V, ϵ are unchanged

except by factors that become

zero $V=0, \epsilon=0, \beta=0, \gamma=0$, set some

surfaces. However, factors can represent a

change in set of k values (k_1, k_2, k_3) or

(k_1, k_2, k_3) and it means that the

factor the linearization about singularities

can yield a different character for

~~the~~ singularity. He has now gotten

stable & unstable spirals for third singularity

dependent upon which branch Δ it

lies, also, today, get circular spirals, he

thinks.

One idea I got today from his V, ϵ

results is that we can gain more

3/9/72 continued

2

A

insight about the third singularity by using ϵ lock with the ϵ value at the third sing.

Then can have a useful 2 dimensional plot. ~~ϕ~~ f lock works well at origin and saddle. Presumably ϵ lock will work pretty well at third singularity because Stone has already shown that V, f plots are not very sensitive to ϵ in this region.

We may gain more insight into the spiral singularities.

Other idea was to ask how our V, ϵ, f singularities apply to the PDE system.

ie.
$$\frac{\partial V}{\partial t} = \frac{\partial^2 V}{\partial x^2} + f_1(V, \epsilon, f)$$

$$\frac{d\epsilon}{dt} = f_2(k_1, k_2, k_3, k_4, V, \epsilon, f)$$

$$\frac{df}{dt} = f_3(k_5, k_6, k_7, \epsilon, f)$$

Now, for const propagation, $\frac{\partial^2 V}{\partial x^2} = \left(\frac{1}{c}\right)^2 \frac{\partial^2 V}{\partial t^2}$

Then, isoclines ~~for V, ϵ, f~~ surfaces are the same as before because set \dot{V} and \dot{V}' both zero.

A

insert about the third singularity in way
 look into the 3 values at the third sing.
 Then can have a useful 3 dimensional
 plot. ~~the~~ 3 look values well at origin
 and saddle. In summary 3 look will work
 pretty well at third singularity because
 there has already shown that 1/2 plots
 are not very sensitive to 3 in this region.
 We now go in more insight into the third
 singularity.



Overtakes us to take have our 1/2, 1/2.
 singularity apply to the PDE system.

$$\frac{\partial V}{\partial t} = \frac{\partial V}{\partial x^2} + f_1(V, \epsilon, \delta)$$

$$\frac{\partial C}{\partial t} = f_2(k_1, k_2, k_3, k_4, V, \epsilon, \delta)$$

$$\frac{\partial Z}{\partial t} = f_3(k_1, k_2, k_3, \epsilon, \delta)$$

Now, for each proposition, $\frac{\partial V}{\partial x^2} = \frac{1}{2} \frac{\partial^2 V}{\partial x^2}$

Then, ~~we can see~~ surfaces are the
 same as before because at 1/2 it's the same.

Therefore, surfaces, intersections & singularities are all the same as before, but, nevertheless, the λ for linearization about singularity will be changed & hence the character of singularities could be changed.

Note, conduction velocity, C in terms of λ is presumably unique for particular kinetics. But why did it blow up for Hatt & for Cole & FitzHugh when not exactly correct? Here, we can ask ~~how~~ how character of our singularities is affected by value of C .

Next point; Suppose conditions are not uniform

$$\text{Can we say } \frac{\partial V}{\partial x} = f(x) \frac{\partial V}{\partial t} \quad ?$$

$$\text{and } \frac{\partial^2 V}{\partial x^2} = \frac{\partial f}{\partial x} \frac{\partial V}{\partial t} + f(x) \frac{\partial^2 V}{\partial t^2} \quad ?$$

Not sure whether this is valid or not.

If it is valid, again, ~~at the~~ top half of page would hold for singularities.

Steve & I decided we could investigate

Therefore, uniform, interactions & superlattices are all the same as before, but, nevertheless, the μ for linearization about equilibrium will be changed & hence the character of superlattices will be changed. Note, combination velocity, C in terms of λ is presumably unique for particular materials. But, when it is blown up for that & for the μ for λ when not exactly correct? Here, we can also have character of our superlattices is affected by value of C .



Next point: suppose conditions are not uniform

Can we say $\frac{2V}{3x} = f(x) \frac{2V}{3t}$?

and $\frac{2V}{3x^2} = \frac{2V}{3x} + \frac{2V}{3t}$

Not sure whether this is vector or not. If it is vector, again, ~~the~~ top half of page would hold for superlattices. Stern & I decided we could investigate

This question with the tapered core conductor,
where

$$\frac{\partial V}{\partial t} = \frac{\partial^2 V}{\partial z^2} + K \frac{\partial V}{\partial z} + f(V, \epsilon, \delta)$$

and for $\epsilon + \delta$ fixed, $f(V, \epsilon, \delta) = k^2(V^* - V)$
(N.Y. Acad 62)

C ∴ first question is
to see if $\frac{\partial V}{\partial x} = f(x) \frac{\partial V}{\partial t}$ for this, in general *no it is not*

Stave will look at this, using our general solution
for the passive membrane problem with $K \neq 0$

But maybe OK for propagation with slowly changing velocity & shape

After we have this answer, we can also consider the
more general question for compartments, or
multiple regions, ala Sargent.

The point is that the ϵ & δ equations are
not affected directly. Only the V equation
is affected directly, and the question is,
exactly how, for each problem of interest.

Exciting because may be key to treating regions
where impulse slows & hesitates or fails.
Gets away from const. prop. in infinite cylinder



Progress

1. ORN - Ma, Goswami

2.

Bh 4

Start.

3/11/64

p.1

9/17/64

92

8/22/64

9.11

$$\text{Radial } \Delta A = m \Delta x \pi d$$

$$\text{But } \Delta x = \lambda \Delta X$$

$$\therefore \Delta A = m \lambda \Delta X \pi d$$

now, if ΔX is same for each step
& $\lambda \propto d^{1/2}$

$$\Delta A \propto m d^{3/2} \propto \text{const. for} \\ \text{equiv. cyl constraint.}$$

reference from Ed Butz

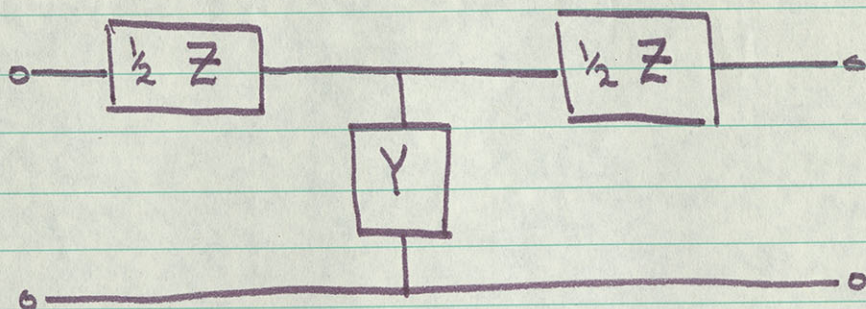
Skilling, H. (1951)

Electrical Transmission Lines

McGraw Hill

Given Cable with series imped. z /unit length
shunt. admit y " "

then a length, Δx , of this cable approx. by T-section network



where

$$Z = z \Delta x \frac{\tanh\left(\frac{1}{2} \gamma \Delta x\right)}{\frac{1}{2} \gamma \Delta x}$$

$$Y = y \Delta x \frac{\sinh\left(\frac{1}{2} \gamma \Delta x\right)}{\frac{1}{2} \gamma \Delta x}$$

and

$$\gamma = \sqrt{zy}$$

Const. prop velocity.

Corresponding points -

A - peak where $\frac{dV}{dx} = 0 = \frac{dV}{dt}$

$$\frac{\partial^2 V}{\partial x^2} = F = \left(\frac{dx}{dt}\right)^2 \frac{\partial^2 V}{\partial t^2}$$
$$= \left(\frac{1}{c^2}\right) \frac{\partial^2 V}{\partial t^2}$$

$$\frac{\partial^2 V}{\partial z^2} = F \quad \text{for } K \neq 0$$

pressure this

B - inflection point

$$\frac{\partial^2 V}{\partial x^2} = 0 = \frac{\partial^2 V}{\partial t^2}$$

$$K \frac{\partial V}{\partial z} - \frac{\partial V}{\partial t} = F$$

$$(K+C) \frac{\partial V}{\partial z} = F$$

$$C = \frac{F}{\frac{\partial V}{\partial z}} - K$$

$$\text{for } K=0, C=C_0 = \frac{F_0}{\frac{\partial V_0}{\partial z}}$$

$$\text{for } K \neq 0, C_1 = C_1 = \frac{F_1}{\frac{\partial V_1}{\partial z}} - K$$

Curious that

$$\frac{F_1}{\frac{\partial V_1}{\partial z}} = \frac{F_0}{\frac{\partial V_0}{\partial z}}$$

Pressure const
propagation
depends on
Relation of slope to
forcing (in a
inflection point

For me or Klee

Start with single cell field
transform ~~to~~ from polar
to cylindrical coords.

Then show how adding
an infinite array leads
to one dimensional field
in limit.

also, for spherical case
transform polar to pop. center
& show how complete array
gives radial field, then
solve hemisphere & sphere
with hole.

Monday
August 9, 1971 checklist

Steve Goldstein

Short paper on Dendritic Spines

Appendix for Tom Reese (Table)

Main papers on Dendritic Spines.

Paper on sphere

Paper on placing in field

Paper on calc of T_p & Halfwidth.

Paper on

- Letter to Don Kennedy & Perkel re neural coding.
- Letter to Shimas & Micholson
- Hear from Mae Kay

Reply to Ingraham - Ed of Chapman & Hall

✓ Get Slides & order prints

✓ Munich Hotel Reservations

○ Notes for slides

○ Write paragraphs about Chang & Berkeley etc.

○ Write FF about isolation etc.

Problems for Steven

Explore Series Solutions.

Volterra Stuff with exact.

Small Networks

○ Bull-glomerulus etc.

Potential Modes of Operation

Phone John Evans { what is he doing
Phone Maurice Klee

From N.Y. Acad. Paper

$$\frac{\partial V}{\partial T} = \frac{\partial^2 V}{\partial z^2} + K \frac{\partial V}{\partial z} + k^2 (V^* - V)$$

where $k^2 = 1 + \epsilon + \eta$
is a constant

Now, this tells us that

$$I_{mRm} = \frac{\partial^2 V}{\partial z^2} + K \frac{\partial V}{\partial z} = \frac{\partial V}{\partial T} - k^2 (V^* - V)$$

How to eliminate space derivatives of V without being trivial? For the usual special case

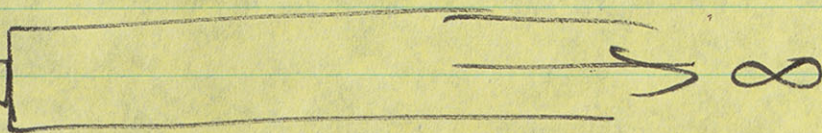
$$\begin{array}{l} K=0, z=x \\ \text{assume } \frac{\partial V}{\partial z} = \frac{\partial V}{\partial x} = \frac{1}{c} \frac{\partial V}{\partial t} \\ \frac{\partial^2 V}{\partial z^2} = \left(\frac{1}{c}\right)^2 \frac{\partial^2 V}{\partial t^2} \end{array}$$

But, we ~~do not~~

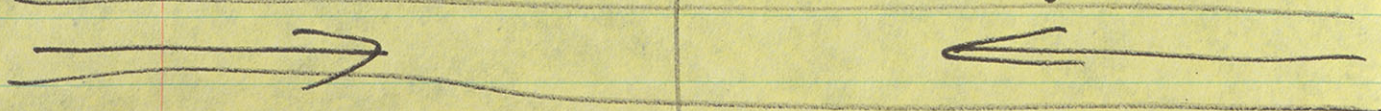
wish to test $K \neq 0$ and $\frac{\partial V}{\partial z} \neq \frac{1}{c} \frac{\partial V}{\partial t}$

perhaps slow const velocity
faster const vel

Resonance point



Collision is simplest case where velocity must become changed.



$$\frac{\partial V}{\partial T} = \frac{\partial^2 V}{\partial x^2} - V$$

askung $\frac{\partial V}{\partial T} + V \stackrel{?}{\propto} \frac{\partial^2 V}{\partial x^2}$

$$V = A_0 e^{-T} + \sum A_n \cos \frac{n\pi z}{L} e^{-(1 + \frac{n^2 \pi^2}{L^2})T}$$

$$\frac{\partial V}{\partial t} = -A_0 e^{-T} - \sum A_n \cos \frac{n\pi z}{L} (1 + \frac{n^2 \pi^2}{L^2}) e^{-(1 + \frac{n^2 \pi^2}{L^2})T}$$

$$V + \frac{\partial V}{\partial t} = - \sum A_n \cos \frac{n\pi z}{L} e^{-(1 + \frac{n^2 \pi^2}{L^2})T} \left(\frac{n^2 \pi^2}{L^2} \right)$$

$$\frac{\partial^2 V}{\partial x^2} = A_0 e^{-T} + \sum (1 + \frac{n^2 \pi^2}{L^2})^2 e^{-(1 + \frac{n^2 \pi^2}{L^2})T} A_n \cos \frac{n\pi z}{L}$$

$$\frac{\partial^2 V}{\partial x^2} = \underbrace{A_0 e^{-T}}_{\text{const}} + C_2 \frac{\partial^2 V}{\partial x^2}$$

$$\frac{\partial V}{\partial T} - \frac{\partial^2 V}{\partial x^2} = f(V, \dots)$$

$$\frac{1}{\sqrt{\pi t}} e^{-l}$$

$$\frac{\partial V}{\partial T} = \frac{\partial^2 V}{\partial z^2} + K \frac{\partial V}{\partial z} + f(V, \epsilon, \rho)$$

✓ if $\frac{\partial V}{\partial z} = h(z) \frac{\partial V}{\partial T}$

Then $\frac{\partial^2 V}{\partial z^2} = \frac{\partial h}{\partial z} \frac{\partial V}{\partial T} + h^2 \frac{\partial^2 V}{\partial T^2}$

∴ $\frac{\partial^2 V}{\partial z^2} + K \frac{\partial V}{\partial z} = h^2 \frac{\partial^2 V}{\partial T^2} + \left(K h + \frac{\partial h}{\partial z} \right) \frac{\partial V}{\partial T}$

Which becomes zero when $\frac{\partial V}{\partial T} + \frac{\partial^2 V}{\partial T^2}$ are zero

for isocline surface

∴ all surfaces the same
intersection was same
of singularities the same

But character of singularities (λ_s) changed

because linearized $\frac{dV}{dT}$ ~~is changed~~
about singularity

is now changed

Take given's form $G = \frac{A}{\sqrt{T}} e^{-\left(\frac{x^2}{4T} + T\right)}$

$$\frac{\partial G}{\partial T} = A e^{-()} \left\{ -\frac{1}{2} T^{-3/2} + \frac{x^2}{4T^2} \frac{-1}{\sqrt{T}} \right\}$$

$$= \cancel{A} G \times \left[\frac{-1}{2T} + \frac{x^2}{4T^2} \right]$$

$$\frac{\partial G}{\partial x} = \frac{A}{\sqrt{T}} e^{-()} \left[-\frac{2x}{4T} \right]$$

$$\frac{\partial^2 G}{\partial x^2} = \frac{A}{\sqrt{T}} e^{-()} \left[-\frac{1}{2T} + \frac{x^2}{4T^2} \right]$$

$$= G \times \left[-\frac{1}{2T} + \frac{x^2}{4T^2} \right]$$

✓ $\frac{\partial^2 G}{\partial T^2} = \cancel{G \times}$

$$A e^{-()} \times \left[-\frac{1}{2} T^{-3/2} + \frac{3}{4} T^{-5/2} - \frac{5}{8} x^2 T^{-7/2} \right]$$

$$+ \left(\frac{x^2}{4T^2} - 1 \right) \left(-T^{-1/2} - \frac{1}{2} T^{-3/2} + \frac{1}{4} x^2 T^{-5/2} \right)$$

$$= A e^{-()} \times \left[+T^{-1/2} + T^{-3/2} \left(-\frac{1}{2} + \frac{1}{2} \right) + T^{-5/2} \left(\frac{3}{4} - \frac{x^2}{4} - \frac{x^2}{4} \right) \right]$$

$$+ T^{-7/2} \left(-\frac{5}{8} x^2 - \frac{1}{8} x^2 \right) + \frac{x^4}{16} T^{-9/2}$$

$$= G \times \left[1 + \frac{3-2x^2}{4T^2} - \frac{3x^2}{4} T^{-3} + \frac{x^4}{16T^4} \right]$$

$$\frac{\frac{\partial^2 G}{\partial T^2}}{\frac{\partial^2 G}{\partial x^2}} = \frac{\frac{x^4}{16T^4} - \frac{3x^2}{4T^3} + \frac{3-2x^2}{4T^2} + 1}{\frac{x^2}{4T^2} - \frac{1}{2T}}$$

$$= \frac{\frac{x^2}{4T^2} - \frac{3}{T} + 2 + \frac{\frac{3}{4T^2} + 1}{\frac{x^2}{4T^2}}}{1 - \frac{1}{2Tx^2}}$$

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Thoughts after Klee's seminar

He focuses on soma shape & neglects dendrites.
Need to couple both to get correct answers.

For many purposes dendritic geometry is main thing.
However, for trigger zones, somatic geometry
may matter.

He thinks low resistance hole (due to synapse)
has major effect due to field it lies in.
This must be evaluated relative to the
battery component of synapse. May be
* possible with tissue culture muscle
cells (Fischback) which are similar
to prolate ellipsoids & can have holes
punched in various ways.

My sphere papers & dendritic generalizations
must be brought soon.

Also, effd of field on dendritic neuron.

Nicholson & Holmes reprint arrived. Must restudy
before Gordon Conf.